

to a variation of only 0.01" in the apparent diameter, an unmeasurable quantity.

CAMERA OBJECTIVES FOR SPECTROGRAPHS.—No. 4, vol. xxix., of the *Astrophysical Journal* contains an interesting practical paper, by Mr. Plaskett, of the Dominion Observatory, Ottawa, describing a large number of tests he has carried out whilst endeavouring to find the most universally useful form of objective for spectrographic work.

A number of tests were made by Hartmann's extra-focal image method adapted to spectrographic work, and the results are given in detail and illustrated by diagrams. For a dispersion of three prisms with a camera of fairly long focus, it was found that, of the objectives tested, the Zeiss "Chromat" and the Brashear Light Crown were the best. The former gives a flatter field and slightly better definition, but for the latter there is the advantage that the plate has to be inclined only 8° instead of 16°, and the absorption is less. For short-focus work the Zeiss Tessar and the Ross Special Homocentric gave good definition and flat fields.

THE ASTROGRAPHIC CONFERENCE AT PARIS.

THE permanent committee of the Astrographic Congress of 1887, as our readers are aware, recently held its fifth meeting at Paris. Invitations were by no means confined, however, to members of that committee, and they were largely accepted by other astronomers. The following were present, representing observatories cooperating in the work:—

Algiers: Gonnessiat; *Belgium:* Lecointe; *Bordeaux:* Picard and Kromm; *Cape of Good Hope:* Hough; *Catania:* Ricco; *Greenwich:* Cowell; *Helsingfors:* Donner; *Oxford:* Turner; *Paris:* Baillaud; *Perth (W. Australia):* Cooke; *Potsdam:* Scheiner; *Rome:* Lias; *San Fernando:* Azcarate; *Tacubaya:* Valle, Gallo; *Toulouse:* Cosserat, Montagerand; *Sydney* and *Cordoba* were not represented, owing to the recent deaths of their respective directors.

The following astronomers and others were also present:—

America: Hale, Leuschner, Perrine, Ritchey; *Austria:* Palisa; *Belgium:* Delvosal; *Denmark:* Strömgen; *France:* Andoyer, André, Angot, Bayet, Benoit, Prince Roland Bonaparte, Bouquet de la Grye, Bourget, de la Baume Pluvinel, Carpentier, Darboux, Deslandres, Fontana, Fournier, Gaillot, Gautier, P., Hanusse, Hatt, Lagarde, Lallemand, Lippmann, Lumière, Verschaffel; *Paris Observatory:* Baillaud, J., Bigourdan, Bouquet de la Grye, Hamy, Leveau, Puiseux, Renan; *Germany:* Hartwig, Kustner, Zührhellen; *Great Britain:* Dyson, Franklin-Adams, Sir David Gill, Hinks, Knobel, Major MacMahon; *Holland:* Bakhuyzen, Kapteyn; *Italy:* Boccardi; *Russia:* Backlund.

The conference assembled at the observatory at 10 a.m. on Monday, April 19. For nearly an hour the members were occupied in mutual greetings, introductions, and general conversation. The chair was then taken by M. Charles Bayet, Conseiller d'État, Directeur de l'Enseignement supérieure au Ministère de l'Instruction publique et des Beaux Arts, who delivered an address, bidding the members welcome in the most cordial terms, and expressing on the part of his Government and of the Republic their interest in and sympathy with the great work to promote which so many astronomers had now assembled from all parts of the world. M. Baillaud, director of the Paris Observatory, then delivered an admirable address. He thanked the assembly for the honour done him by electing him unanimously as their president so soon after his appointment as director of the Paris Observatory. He briefly traced the history of the undertaking known as the "Carte du Ciel," which had its origin in 1887. He referred in touching terms to Admiral Mouchez, to whom the "Carte du Ciel" owed in a great degree its successful origin; to Tisserand, whose classic labours so adorned the science that he loved; and to Lœwy, who had done so much, not only to develop the Paris Observatory, but to extend the scope and usefulness of the work of the "Carte du Ciel." He described the great share which

Lœwy had taken in collecting, discussing, and printing the observations of Eros in 1900, which, in the hands of Mr. Hinks, had led to a very accurate determination of the solar parallax. He showed that by undertaking these observations, not only had thus a most important result been arrived at, but by the refined discussion of the observations of Eros some important systematic errors in photographic observation had been detected, and the sources of these errors found. We had, in fact, by this extension of our field of work, not only arrived at important new results, but greatly improved the results of our previous labours.

But much yet remained. We had now, for example, to study the problems of perfecting the systematic corrections applicable to the preliminary determinations of magnitude and position of all the catalogue stars, so that when the work of the different zones had been completed the final catalogue should present a harmonious whole. It was also necessary that we should make preparation for the regular observation of Eros in future, and begin to consider what should be done in order to take the fullest advantage of the extraordinarily favourable opposition of that planet in 1931. Everything that we did to improve the work of the catalogue would go towards perfecting the determination of the places of the comparison stars to be observed with Eros from now until 1931, and the necessary striving after systematic accuracy which must result from such researches must react in the way of improving the fundamenta of sidereal astronomy.

Such, at least, are the writer's recollections (without notes) of this admirable and inspiring address, after the delivery of which M. Baillaud, in a few graceful words, proposed the election of Sir David Gill as "Président d'Honneur," a proposal which was carried by acclamation.

The bureau of the general assembly was then constituted as follows:—*vice-presidents*, Bakhuyzen, Backlund, Kapteyn; *secretaries*, Donner, Puiseux, Scheiner, Turner.

A suggested programme for the work of the meeting had been prepared by Sir David Gill, and was circulated by the president, M. Baillaud, in January last. This programme was accepted by the meeting, and, in accordance with it, the president formally presented two volumes, one marked A, containing advance proofs of the printed reports of the progress of the work of the chart and catalogue at the different cooperating observatories, and another, also in proof, marked B, containing papers and discussions of very great interest, such, for example, as Hinks's report on his great discussion of the Eros observations, Campbell's report on Perrine's discussion of the Eros observations made at the Lick Observatory, Hough's paper on a proposed method for the *raccordement* of astrographic plates, E. C. Pickering's report on a standard scale of photographic magnitudes, and other papers on kindred subjects by J. Baillaud, Pourteau, Cohn, and Millozevich.

Then, in accordance with the programme, the conference was divided into five commissions, viz.:—

(A) To report on the state of the work and the steps to be taken to perfect or accelerate the work.

(B) To report on the method to be adopted for the conversion of measured diameters of star-discs (or magnitudes, as estimated at the different observatories) into an exact and uniform system of magnitudes.

(C) To report on the existence and probable origin of systematic errors in the measured coordinates of star-discs on certain plates, on the best methods for avoiding such errors in the future, and of putting in evidence and eliminating their effects in the plates already measured.

(D) *The Catalogue Committee.*—To examine the origin of the star-positions employed in the preliminary reduction of the plates of each zone, to study the best means of coordinating the star-places of the different zones, and to determine the systematic corrections necessary to reduce the whole to a uniform and absolute system.

(E) *The Eros Committee.*—(1) To report on the steps to be taken for the preparation of a preliminary ephemeris of Eros at its opposition in 1931 of sufficient precision to permit the early selection of comparison stars. (2) To propose means for the regular observation of the planet from the present time onwards in order to perfect the ephemeris which will be finally employed for the definitive

reduction of the observations in 1931, that is to say, for the direct determination of the solar parallax and mass of the moon, as also for the ultimate determination of the mass of the earth by means of the perturbations which it produces in the motion of Eros.

The *bureaux* of these committees were then constituted as follows:—

	A	B	C	D	E
President	Turner	Kapteyn	Bakhuyzen	Kustner	Backlund
Vice-Pres.	Donner	Puiseux	André	Hough	Dyson
Secretary	Andoyer	Bourget	Hamy	Luc. Picart	Lagarde
"	—	Azcarte	Valle	Ricco	Hinks

A list was then submitted suggesting the names of members who should serve on the different committees, although any member of the conference was at liberty to attend and vote on any of the committees he pleased. As there was sufficient accommodation at the observatory a separate room was assigned to each committee. The conference then adjourned for the day, and many of the members attended the meeting of the Academy of Sciences at the Institute in the afternoon.

The committees sat from 10 to 12.30 in the morning, and from 3 to 5 in the afternoon, on Tuesday, Wednesday, and Thursday, April 20, 21, and 22, and by the latter date had completed their labours.

On Friday morning, April 23, the resolutions of the various commissions were successively submitted to the general conference, and, as a rule, were adopted without change. The resolutions as finally adopted are as follows:—

From Commission A.

The committee expresses the desirability that the measures of the catalogue plates made at Sydney and Melbourne should be published as soon as possible, and that a copy of this resolution be sent to the Governments concerned.

It is desirable that the zone (dec. -17° to 23°) not yet commenced should, for the catalogue, be divided between the observatory of Santiago, the new observatory of Hyderabad (Deccan), and, if necessary, the observatory of the University of La Plata. M. Baillaud is charged to arrange with the directors of these observatories for the partition of the work.

It is desirable that the Cordoba zone (dec. -24° to -30°) should be divided for the catalogue between the observatories of Cordoba and the Cape of Good Hope. M. Baillaud will arrange with Mr. Perrine, the new director of the Cordoba Observatory, for this subdivision of the work.

The permanent committee directs attention to the interest which attaches to a repetition of the catalogue plates even after so short an interval as ten years. The high precision of the measures will already furnish indications of proper motion. It invites observatories, which are in a position to do so, to repeat the catalogue plates, taking care that the repeated plates be made at the same hour-angle and at the same season of the year as in the earlier series.

From Commission B.

The participating observatories are recommended to make direct photographic comparisons between the star-images of the polar area and twenty-four regions of the particular zone undertaken at each observatory.

In this comparison two exposures of each area shall be made, one of six minutes and one of twenty minutes, the two regions being taken at equal zenith-distance and in conditions as similar as possible.

Those observatories where the construction of the telescope mounting prevents access to the polar region may utilise the Pritchard-Kapteyn areas for the above-described comparison. For the plates in the neighbourhood of the pole it is recommended to select twenty-four areas, selected in the manner that appears most convenient to the astronomers engaged on the work.

It is to be understood that there is no objection to the making of the above-mentioned comparisons of different exposures on two different series of plates, nor to making additional series with different exposures.

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The committee recommends a second series of twenty-four plates connecting in pairs the twenty-four type-regions of the same zone.¹ In this series there should also be two exposures, viz. of six minutes and twenty minutes respectively, for each of the two regions compared; but, as before, there is no objection to the making of the above-mentioned comparisons of different exposures on two different series of plates, nor to making additional series with different exposures.

The committee recommends that the astronomers whose zones include the declinations $\pm 0^{\circ}$, $\pm 15^{\circ}$, $\pm 30^{\circ}$, $\pm 45^{\circ}$, $\pm 60^{\circ}$, and $\pm 75^{\circ}$ should select Kapteyn's selected areas for their type-regions, or at least regions including these selected areas.

The committee is of opinion that several observatories should also undertake the photography of the Kapteyn-Pritchard areas, connecting each of them, on the same plate, with the pole, some with the North and others with the South Pole, and taking care to make both exposures under conditions (as to Z.D., &c.) as similar as possible.

The *raccordement* of the other regions of any zone with the corresponding type-regions of that zone may be made in a variety of ways. The committee thinks that the choice of the method of *raccordement* should be left to the participating observatories.

The committee, believing it to be premature to fix in an absolute manner the origin and interval of the scale of photographic magnitudes, entrusts the solution of the problem to a commission constituted as follows:—Backlund, B. Baillaud, Gill, G. Hale, Kapteyn, E. C. Pickering, Scheiner, Turner.

The members of this commission are recommended to select a photographic scale that is independent of the visual scale. Stars of the ninth magnitude of the visual scale should be taken as the point of departure for the photographic scale. Until the commission has completed its labours observers should continue to publish the magnitudes of stars on the same basis as that previously adopted by them, on the understanding that each participating observatory shall describe, with all desirable precision, the methods which have been adopted to determine the published magnitudes. In this way the corrections necessary to pass from the scales respectively adopted by the different observatories to the absolute scale which will result from the labours of the commission can be made with the minimum of uncertainty. At the present moment the scale most to be recommended is that which is defined by "the North Polar sequence of forty-seven stars" due to Prof. E. C. Pickering.

Observers may with advantage give to the three images of the same star on the chart plates such a linear interval that the three images of a star of the eleventh magnitude shall appear neatly separated.

Observers may diminish the duration of the exposure of each of the three images (on a chart plate)—from thirty to twenty minutes, for example—if it is recognised that the diminished exposure is sufficient to show the images of stars of the fourteenth magnitude on Argelander's scale, prolonged.

The attention of participating astronomers is directed to the advantages which might arise if the three exposures on the chart plates were made on different nights, with a moderate interval, of not more than several weeks in all. It appears preferable, indeed, to complete the plate-exposure on two nights only, with one exposure on the first night and the other two exposures on the second night. The advantages which would result from this plan of working would, on the one hand, be to facilitate the search for variable stars, and on the other the eventual discovery of a trans-Neptunian planet.

From Commission C.

At least twice a year the equatorial adjustment of the photographic telescopes should be tested.

Special attention must be given to the centring of the object-glass, and to the rendering of the surface of the

¹ It was understood that in this way the region of R.A. oh. should be taken at 3h. hour angle W., and on the same plate the region of R.A. 6h. at 3h. hour angle E. (i.e. at approximately the same Z.D.), then R.A. 12h. on the same plate with R.A. 7h. and so on.

film normal to the axis of the object-glass. To examine the quality of the object-glass or its distortion Hartmann's perforated screen method is recommended, its efficacy having been already proved.

In order to determine the effects of optical distortion depending on the position-angle and distance, special plates of the Pleiades should be taken. These plates should also serve to show whether the formulæ and methods previously employed in the reduction are sufficiently accurate and complete. The committee is of opinion that the optical errors should be studied on the plates already measured by the methods referred to by Prof. Turner in Annex A (reports of the participating observatories).¹

It is also desirable that observations should be made to determine the relative flexure of the photographic and visual telescopes.

From Commission D.

The permanent committee, convinced of the importance of the (meridian) determination of the positions of the *étoiles de repère* as contemporaneously as possible with the exposures of the plates, expresses its high satisfaction that these stars have been so observed, or are about to be observed in the near future.

With reference to these observations which have as yet to be made, the committee addresses its thanks to MM. Verschaffel, Backlund, Struve, and Boccardi, who have so kindly undertaken this outstanding work, and rests assured that these observations will be made by them with all desirable precision and promptitude.

The committee is of opinion that, in the future, meridian observations of faint stars, excepting for special researches, should be limited to the stars which have been selected as *étoiles de repère* for the catalogue plates. In this way the positions of the great majority of the stars (to the eleventh magnitude) can be determined with the greatest facility and precision.

Meridian observations may be divided into three classes, viz. fundamental stars; intermediate stars; *étoiles de repère*.

Fundamental Stars.—These should be so chosen that there shall be one star in each area of twenty-five square degrees, so that their distribution in the sky may be as uniform as possible. The observatories willing to unite in the formation of a new fundamental system should agree to select a common list of stars, and to observe all stars of that list which culminate at suitable altitudes above their respective horizons.

The observatories which at first sight appear to be available for this cooperation are:—in the northern hemisphere, Algiers, Greenwich, Leyden, Lick, Kiel, Paris, Pulkova, Odessa, Washington; in the southern hemisphere, Cape of Good Hope, Sydney. This resolution does not exclude the cooperation of other observatories for fundamental work, provided that they have time and instruments of the necessary type.

Intermediate Stars.—A second series, called intermediate stars, and preferably of the eighth to ninth magnitude, shall be established. These stars will be selected for the purpose of determining the positions of the *étoiles de repère* with respect to the fundamental stars with the least systematic error possible, with the view of the elimination of personal equation depending on magnitude both in right ascension and declination. The Bonn Catalogue of Stars for 1900, dec. 0° to 51° , offers an example of methods by which such a catalogue can be constructed. It is known that a similar catalogue is about to be made between dec. 51° and 90° at the Observatory of Kasan.

It is desirable that analogous observations should be made in the northern hemisphere, and, if it is possible, that two similar series or more should be made in the southern hemisphere. The stars which should be chosen for these additional series may be less numerous than those above indicated, but they ought to be taken exclusively from the adopted lists of *étoiles de repère*, and selected so that there shall be from four to six stars per hour in each zone of two degrees in breadth.

¹ The present writer thinks that a more complete system, viz. that described by Mr. S. S. Hough (Annex B), has been overlooked by the committee.

So far as the determination of the positions of the intermediate stars is concerned, the observatories which have good recent meridian observations of the *étoiles de repère* need not of necessity re-observe them. It will only be necessary to determine the mean corrections of the positions of the *étoiles de repère* of each plate by comparing the formerly adopted positions of these stars with the definitive positions of the intermediate stars; but for all meridian observations of the *étoiles de repère* made subsequent to the publication of the definitive positions of the intermediate stars it will be desirable to employ these positions as a basis for the reduction of the observations.

The commission charged with this work by the permanent committee will consist of the directors of the observatories engaged in cooperation, together with Messrs. Auwers, Gill, Kustner, and Newcomb.

The following supplementary resolution was added in general committee:—

The committee is of opinion that, in consideration of the small number of observatories fitted for fundamental work of high precision in the southern hemisphere, it is very desirable, in the interests of science, that a meridian instrument provided with all modern improvements should be installed in Australia. The establishment of a new observatory near Sydney offers a very fortunate opportunity for the fulfilment of this great astronomical desideratum. A copy of this resolution to be transmitted to the Government of New South Wales through the usual diplomatic channels.

From Commission E.

Mr. Strömgren is charged to compute:—(1) an approximate ephemeris of Eros for 1931; (2) precise ephemerides for the successive oppositions until 1931; (3) an ephemeris of high precision for 1931.

The committee expresses the desire that the ephemerides of Eros, relative to successive oppositions, be inserted in the chief official ephemerides—Nautical Almanac, Connaissance du Temps, &c.

The committee is of opinion that an international arrangement should be arrived at for the computation, as soon as possible, of the heliocentric positions of the chief perturbing planets—Venus, Earth, Mars, Jupiter, and Saturn—so that Mr. Strömgren may furnish in the course of a few years an ephemeris of Eros for 1931 which will be sufficiently accurate to permit the selection of the comparison stars.

The committee recommends the regular observation of the planet Eros from the present epoch onwards. These observations should be made, not only at opposition, but as long before and after each opposition as possible.

For the oppositions previous to 1931, observatories are requested to publish their results as early as possible. Especially in the case of photographic observations, the rectilinear coordinates of the planet and of the comparison stars should be given. So far as possible, these should refer to the *étoiles de repère* of the photographic catalogue for the region; the provisionally derived right ascension and declination of the planet should also be given.

As the *étoiles de repère* have already been selected for the whole sky, one can easily ascertain (for example, by correspondence) the stars to be measured with Eros.

From the Meeting of the General Committee.

The committee appoints a commission, viz. Messrs. Knobel, Lippmann, Perrine, and Turner, to examine the question of the production of star-images on a photographic plate both from the optical and photographic point of view, and to study the means of obtaining star-images more susceptible of exact measurement than those at present found on our existing plates.

This commission has power to add to its number.

The meeting concluded with a vote of thanks to M. Baillaud for the perfection of the arrangements made for the business of the meeting, for the ability and tact with which he had filled the post of president, and for the hospitality and kindness he had shown to all.

The following table, extracted from the printed reports,

will enable the reader to judge of the state of the work generally:—

Observatory	Limits of declinations of centres of plates	Number of plates in zone	Catalogue Plates			Chart Plates	
			Taken	Measured	Reduced	Taken	Published
Greenwich	N. 90 to 65	1149	1149	1149	1149	1149	1006
Rome	64 „ 55	1040	720	—	—	103	30
Catania	54 „ 47	1008	590	90	—	97	—
Helsingfors	46 „ 40	1008	1008	679	435	843	—
Potsdam	39 „ 32	1232	1232	300	280	—	—
Oxford	32 „ 25	1180	1180	1180	1180	—	—
Paris	24 „ 18	1260	1260	540	540	373	373
Bordeaux	17 „ 11	1260	958	819	493	127	127
Toulouse	16 „ 5	1080	738	698	?	191	162
Algiers	N. 4 „ S. 2	1260	—	517	425	335	335
San Fernando	S. 3 „ N. 9	1260	1260	1125	323	?	215
Tacubaya	10 „ 16	1266	1260	1121	360	108	88
Cordoba	1 24 „ 31	1360	854	299	—	167	—
Perth	32 „ 40	1376	1376	195	—	—	—
Cape of Good Hope	49 „ 51	1512	1512	1402	803	1512	—
Sydney	52 „ 64	1400	1400	703	—	—	—
Melbourne	65 „ 90	1149	1149	1104	—	1129	—

There was throughout the meeting an earnestness of purpose of a very marked kind, a feeling that decisions having an important influence on the future of astronomy were being taken. Every resolution had been so fully discussed in one or other of the five commissions that in the end they were all adopted with unanimity, not only in the commissions, but at the general conference.

Perhaps the most important of these are the resolutions dealing with the methods to be adopted in connection with the organisation of a united series of meridian observations, and the establishment by international effort of a system of intermediate stars, as originally suggested by Sir David Gill in his presidential address to the British Association at Leicester. Hardly less important are the resolutions in regard to the adjustment of the scale of photographic magnitudes to an absolute and uniform system for the whole sky. Indeed, it is hardly possible to over-estimate the resulting importance of these resolutions to sidereal astronomy if due effect is given to these resolutions.

The plans for the observation of Eros show a still further extension of the work of the committee, for they carry us into another field of astronomy by providing the most refined determinations of the positions of that remarkable planet. If due effect is given to these resolutions, the gravitational astronomer will be provided with means of research on the masses of the moon and of the earth and other planets of a kind never before available. The meeting will also be memorable for the communication made to it by Mr. Hinks as to the result of his eight years of labour in deriving the solar parallax from the international observations of Eros.

Widely indeed has the permanent committee of the Astrophysical Congress of 1887 extended the field of its labours, and with the best results.

Paris was, as usual, profuse in kindly hospitality. Prince Roland Bonaparte gave a reception to the members of the conference and their wives and families at his charming house in the Avenue d'Iéna. On the Thursday Baron Rothschild entertained some of the members to dinner, and on the same evening there was a delightful reception at the Paris Observatory, at which was given a little comedy by members of the Théâtre Français, and a little operetta by members of the Opéra Comique, the evening concluding with a *tour de valse*.

Many private entertainments to members were given at the hospitable homes of the Paris members of the conference, and the whole concluded with a banquet at the observatory on the Saturday evening, at which covers were laid for eighty-two guests.

1 The zones -17° to -23° were originally allotted to La Plata, but as the work has not been done, they are assigned, if not entirely, at least in chief part, to Santiago and the new observatory of Hyderabad (Deccan).

THE AMERICAN PHILOSOPHICAL SOCIETY.

THE general meeting of the American Philosophical Society was held on April 22, 23, and 24. The evening of Friday, April 23, was devoted to a Darwin celebration commemorative of the centenary of Charles Darwin's birth and of the fiftieth anniversary of the publication of the "Origin of Species," at which addresses were given by the Right Hon. James Bryce, the British Ambassador, on personal reminiscences of Darwin and of the reception of the "Origin of Species"; by Prof. G. L. Goodale, of Harvard University, on the influence of Darwin on natural science; and by Prof. G. S. Fullerton, of Columbia University, on the influence of Darwin on the mental and moral sciences.

On the afternoon of April 24 there was a symposium on earthquakes, at which papers were presented by Prof. E. O. Hovey, Prof. W. H. Hobbs, and Prof. H. F. Reid. In addition to the three papers presented at the Darwin celebration on April 23, forty-four papers were read at the morning and afternoon sessions. We have been favoured with a list of these papers and summaries of their contents, but limitations of space prevent us from giving more than an abridged statement of the proceedings. Abstracts of a few of the papers read are subjoined.

The brains of two white philosophers and of two obscure negroes, Prof. B. G. Wilder. The brains of Chauncey Wright and of James Edward Oliver were compared with the brains of two obscure negroes, one a mulatto, the other black, and a remarkable resemblance in the form of Wright's brain with that of the negro brains was pointed out, from which Prof. Wilder drew the inference that the negro is capable of as high development as the Caucasian. Some conditions modifying the interpretation of human brain-weight records, Dr. H. H. Donaldson. An account of the brain-weight records that have been collected at the Wistar Institute of Anatomy. After the fifteenth year, up to the fifty-fifth, the human brain loses slightly in weight, and then more rapidly after that period. This slight loss in weight between the fifteenth and fifty-fifth years is attributed to the influence of those diseases which ultimately end in death.

Some notes on the modifications of colour in plants, Prof. H. Kraemer. After reviewing the previous work on the control of colour in plants, and enumerating the factors which influence the colour in flowers, the author gave the results of his own experiments, which were begun in the autumn of 1904, and have been continued up to the present time. Various soils were experimented with, including an artificial soil, and sand to which a special nutrient was added. The chemicals used to modify the colour principles were supplied to the plants in the form of solutions of varying strength, or added to the soil in the solid form, solution gradually taking place. Probably the most striking result obtained by the use of chemicals was the production of a red colour in the petals of the white rose, Kaiserine. The red pigment occurred in the basal portion of the petals, and was produced in the flowers of plants which were supplied with potassium hydrate, potassium carbonate, calcium hydrate, and lead acetate. Blue flowers were produced by the red-flowering form *Hydrangea* (*H. Otaksa*), growing in both sand and garden soil, when supplied with potassium and aluminium sulphate, aluminium sulphate and calcium hydrate.

Recent work on the physics of the æther, P. R. Heyl. Considerable interest has been taken of late in the question as to whether the æther is or is not a dispersive medium with regard to light. The work of the author, published about a year and a half ago, leads to the conclusion that any dispersion in the æther must be less than 1 part in 250,000. Since that time others have arrived at the conclusion that there exists a dispersive effect of much smaller magnitude, about one part in a million. There seems to be no doubt of the correctness of their observations, but it is not clear that it is to be attributed to a real dispersive effect in the æther. It is more likely that it is due to tidal phenomena in the atmosphere of the variable stars used as sources of light in the experiments.

The detonation of gun-cotton, Prof. C. E. Munroe. In the use of gun-cotton in mines and torpedoes advantage is taken of the discovery of Mr. E. O. Brown that gun-